PARESIS OF INFERIOR OBLIQUE MUSCLE. By HENRY D. NOYES, M.D., New York.

THE symptoms of impairment of the inferior oblique muscle have been sufficiently described; but the occurrence is rare, and a case which afforded unusually good opportunity for being studied may for these reasons be considered worthy to be reported. I, of course, allude to paresis of this muscle exclusively, without any complication of other ocular muscles. Alfred Graefe (see Graefe and Saemisch, Bd. VI., erste Hälfte, p. 45) reports, among 250 cases of muscular impairment, that the inferior oblique was itself alone affected in only two instances.

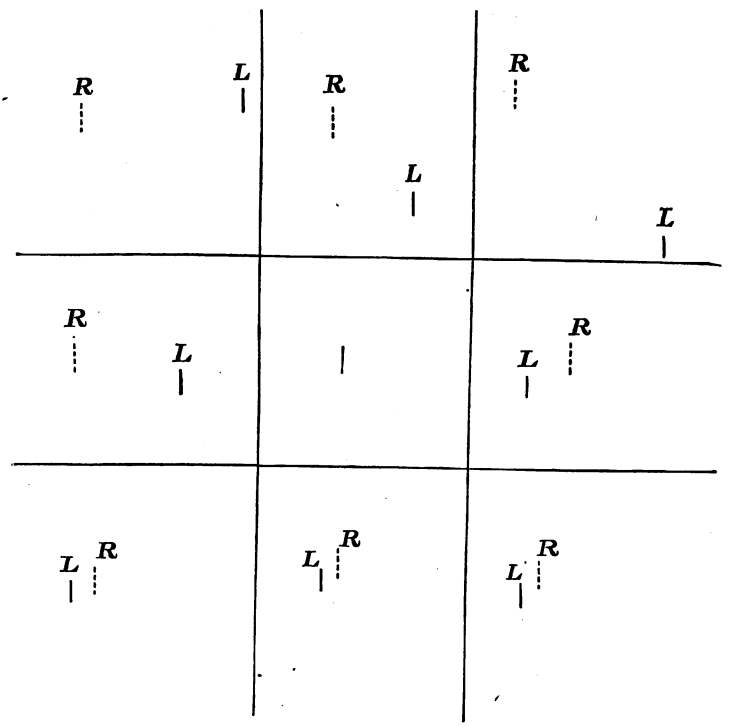
On the 5th of September, 1876, the writer was violently thrown from a horse; was for a few minutes unconscious, had bleeding from the nose, and received a laceration of semilunar form about one and one-quarter inches long, running from the body of the right malar bone upward to within one-fourth of an inch of and curving around the outer canthus. There was emphysema of the lower part of the cheek; sight was not impaired. The injury was upon the right side of the face. During the evening and about four hours after the accident, swelling came on and the wound was closed by a suture. Dr. Hankinson very kindly did what was surgically needful. While lying in bed in a room lighted by a gas-light, which shone through an open door, a well-defined scotoma was projected against the obscure walls. It had a deep crimson hue and occupied an angle of perhaps 7° to 10°. It belonged to the right eye, and was at the centre of the field. All objects could be seen through it, even fine print. This phenomenon continued for several days. Swelling took place, not only in the lids, but in the orbit, causing slight exophthalmus and some serous chemosis. The next morning double vision was observed to be present in all parts of the field. On the fifth day the swelling and exophthalmus had much abated, and the true nature of the accident could be discovered. There was a little emphysema of the cheek; clots of blood were expelled from the fauces and nares; there was slight crepitus of the malar bone and perceptible mobility. There was a sharp notch at the place of

junction between the superior maxilla and the malar bone, and another more shallow depression at the union of the ascending process of the malar with the temporal extremity of the frontal. There was a deep notch at the middle of the inferior orbital edge, and another one at the middle of the outer orbital edge. The act of chewing gave great pain when the right upper canine and its neighbors were put to use. The pain darted with great intensity along the track of the infra-orbital nerve. There was, moreover, a region of numbness covering the most of the ala nasi, and a space beneath the inferior tarsal border equal to the length of the lid and for an inch below. From all these symptoms it was plain that the malar bone had been forced backward and outward so as to be loosened from its attachments to the neighboring bones, and that a line of fracture had gone through the infra-orbital foramen and the place of origin of the inferior oblique muscle. The writer was attending to his affairs on the seventh day, and as the exophthalmus disappeared the diplopia was restricted to a region above the horizon, and did not at all interfere with ordinary vision. For a month after the injury, phosphenes would frequently occur before the right eye. They were chiefly on the temporal side; they were bright yellow and resembled the flame of a torch; they would appear on passing into a dark place, on holding the breath as in singing, on stooping, or upon any sudden movements. They invariably had a bright golden yellow color, without fading into other tints, and their duration was only for an instant. They had a bewildering effect and were disagreeable. On October 4th, Dr. Callan kindly examined the fundus of the eye and found nothing abnormal. There was absolutely no fatigue in using the eyes. By the 22d of January, 1877, the teeth of the upper jaw had recovered sensibility, but numbness of the skin in the space described continued for eighteen months. It may be assumed that this period was necessary for perfect restoration of continuity in the lacerated fibres of the infra-orbital nerve.

The double vision was from the first a subject of curious and attentive study. Five days after the injury the scheme of diplopia, as tested by a red glass and candle flame, gave for the point of direct fixation in front, single vision. At 26° above the horizon two flames appeared, and at the extreme attainable height of the line of vision the images were crossed and of different height, the false image being above, *i. e.*, the right. Along this upper range the vertical separation increased to the right and disappeared to the left, while at the extreme left the false image went a little below the

true. On this same range the lateral separation increased to the right, grew less to the left for a space a little past the medium line, and then again grew wider. Inclination of images was not noted in this examination. Along the middle range there was single vision, as stated above for the centre; to the right there was homonymous diplopia, with the false image above; to the left there was crossed diplopia, and the false image remained above. On the range below

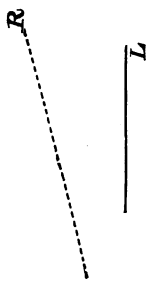
Fig. I.



the horizon there was on the median line diplopia, with images almost above each other; the right eye image being below, to the right the right eye image went above and to the right of the left, and it held the same relations on the opposite side of the lower range. Tested by the perimeter, the region of single vision extended on the median line vertically upward 26°, downward 40°, to the right on the horizon as far as the nose would allow, viz., 45°; to the left on the horizon only to 32°. The oblique meridians were not investi-

gated. Naturally the finding of the perimeter would not accurately correspond to the region of double vision elicited by the red glass and candle. The motive for fusion of images is always less energetic when a red glass covers one eye.

On September 30, 1876, the following diagram was made. The object was a picture-frame hanging on the wall directly in front, and the angle of fixation was about 35° above the horizon. The distortion of both the vertical and horizontal meridians is very clearly displayed.



Another feature of the diplopia was discovered by carrying a horizontal rod along the upper

Fig. 2.

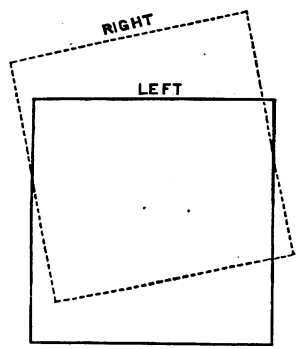
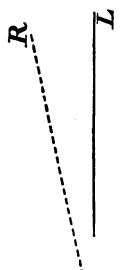


Fig. 3.



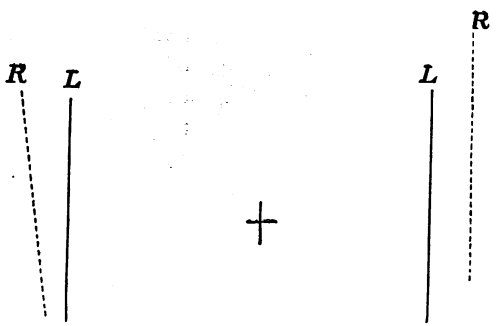
range from right to left. The two images took the subjoined relations.

The excursion was to the extreme limit on both sides, and so far that the right and left eyes were in turn unable to view the whole length of the rod. The facts displayed are that the angle of obliquity and the vertical separation increase on the right, while to the left the false image actually goes below the true and tends to become homonymous. By putting together Figures 2 and 3 it clearly appears how the vertical meridian is made to lean to the median line, and the diminution of its inclination toward the extreme left is to be construed as being in truth a great departure from the correct position, because on that side of the field the vertical meridian has an in-

clination of the opposite kind, viz., from right downward to the left.

The behavior of the vertical meridians on the horizontal range is found to be, that on the right side, when near to an angle of 45°, they remain vertical and parallel while the images are homonymous, the right image going higher. But on the left side the images are not parallel, the vertical meridian of the right eye leans to the left, and also crosses over its fellow. The diagram Figure 4 shows the situation. It would appear from this that on the extreme right the inferior oblique becomes an abductor, and to the opposite side it on the contrary serves as an adductor; by this I mean, of course, in its relations to the visual line of the fellow eye.

Fig. 4.



When the object was below the horizon there was still a vertical displacement of the images, the right being slightly above; but for all positions extreme right, centre, and extreme left, the images were homonymous. The amount of lateral separation was small, and slightly increased on the left as compared with the right side.

These findings were taken within two weeks of the injury. It is fair to infer that the muscle was then clogged with infiltrated blood in addition to the laceration of its fibres. Doubtless the peculiar phenomena just noticed were due to the exclusion of some bundles from action, while others were left to act in a manner not according to their usual line of direction, being unbalanced. At a much later period, viz.: ten months after the injury, it was found that double vision could not be produced until the look was elevated 25° above the horizon, and the diplopia increased steadily above that to the utmost limit of elevation, which is about 45°. To attain this height the eye must be forcibly strained up, and the eyebrows strongly lifted. At the present writing, twenty-two months after the injury, the degree of paresis remains unchanged. At the greatest elevation, the images are separated in height by an angle of less than 5°, and the

angle open to the right, made by holding a rod horizontally at an elevation of 45° is very close to 8°. Of course the vertical meridian will have the same inclination inward from the perpendicular. The attempt to decide the degree of deviation from the perpendicular, by means of the after-image, as Donders suggested, did not succeed. The faint after-image always seemed, during its brief continuance, to be quite vertical. It remains true at this moment of writing that (the eyes turned upward), when a pen-holder is held vertically at arm's length in the upper right corner of the field, it forms double images, of which that seen by the right eye is to the left, is higher and inclined medially, and seems nearer; the other image appears to slope away at the top. This crossing of the images is distinct, and disappears when the object comes half way to the median line; when brought to the median line, one image is directly below, and on a line with the other—the vertical separation being about one-half that found on the extreme right. At about 20° to the left of the median line, single vision takes place. This contradicts, so far as the crossing of the images is concerned, the statement of Prof. Alfred Graefe (see Graefe and Saemisch, l. c., p. 54), who indicates that the images are homonymous. I may remark that my ocular muscles have always been exceptionally strong—that I could fuse images separated by prisms amounting to more than 50° with bases outward, and could overcome prisms of 8° with bases inward—the object being at 20 feet distance. That the right eye is hypermetropic $\frac{1}{30}$, the left hypermetropic $\frac{1}{48}$. That there never have been any symptoms of asthenopia. How to reconcile the discrepancy above noted between this case and the statement of Prof. Graefe, I shall not attempt. That the lesion in my own case befel the right inferior oblique muscle, does not seem to me to admit of a doubt; that any other muscle has been implicated, seems equally devoid of evidence. The insertion of the inferior oblique is by a broad and fan-like expansion, and perhaps the explanation of the above discrepancy between my own symptoms and the statement in Prof. Graefe's article, may be, that in my own case only the fibres of the muscle going to the outer side of its insertion were impaired, and that in this way the adductive power was impaired for the position in question.

Fig. 5.